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TOILET VENTILATION SYSTEM

An Application for U.S. Utility Patent

Before the Untied States Patent Office

In the Name of Robert De Nyse

Possessing as Legal Residential Address:

**6636 Garret Road
Buford, Georgia (GA) 30518**

1 **BACKGROUND OF THE INVENTION**
23 ***Field of the Invention***4 The present invention is concerned with the removal of odors coincident with disposal
5 of human bodily wastes into a toilet porcelain bowl having a hinged seat by supply of
6 negative pressure in ventilation thereof.
78 ***General Background***9 The modern flush toilet, invented by John Crapper, is first recognized as being the
10 single most important amenity of modern civilization without which widespread disease and
11 the prevalent odor of human feces in the streets of all cities would remain in oppression of
12 urban humanity. Chorea, typhoid, dysentery and other deadly diseases have been virtually
13 eradicated from civilization by the invention of John Crapper and the usage of associated
14 sewage systems.15 The repeated outbreak of chorea in Chicago in the 1870s and 80s resulting in the last
16 instance of over 30,000 deaths is testimony to the importance of modern sanitation systems
17 as is its solution: the reversal of the South Branch of the Chicago River and its continuation
18 through the Chicago Sanitary and Shipping Canal from Calumet to the Mississippi River.
19 This, and the 'deep tunnels' providing Manhattan with both potable water from hundreds of
20 miles upstate and sewage disposal for Gotham denizens, are among the largest and most
21 important engineering feats of the modern age. Uncounted dozens died in the creation of the
22 latter and more continue to perish in building its replacement.23 At the present time perhaps the most pervasive reminder of the threat posed by
24 unsatisfactory disposal of human excrement is the odor associated with disposal of the same
25 into the porcelain bowl of a modern flush toilet while sitting upon the generally flat and

1 annularly ovoid shaped hinged seat disposed in parallel, and in spaced apart contact with, the
2 generally flat top surface of the porcelain bowl. Exhaust ventilation of the room having this
3 facility will succeed in preventing the migration of these noxious odors beyond the confines
4 of the same but, obviously, fails to prevent the author of the odors from subjugation to this
5 most unpleasant assault upon the olfactory senses. It is noted that the repulsion triggered
6 through the olfactory system of the human body by these odors is a defense mechanism as
7 human feces carries deadly pathogens and therefore this repulsion is generally universal to
8 the human species and decidedly severe.

9

10 ***Discussion of the Prior Art***

11 A large number of U.S. Patents are known to attempt address of the present problem.
12 In chronological order since the commencement of the latest millennium, as commonly if
13 incorrectly understood to begin with January 1, 2000, one has:

14

15	#	Patent No.	Inventor	Title
16	1	6,019,862	Carwell et al.	Method of Making Integrated Toilet Bowl Exhaust System;
17	2	6,029,286	Funk	Odor Removing Apparatus for Toilets;
18	3	6,041,449	Brown et al.	Apparatus and Method for Treating Objectionable Odors in Toilet Bowls and the Like;
19	4	6,073,273	Tillen	Venting Apparatus for Flush Toilets;
20	5	6,158,058	Martens	Ventilated Toilet;
21	6	6,167,576	Sollami	Ventilated Toilet Seat;
22	7	6,173,453	Shahar	Toilet Venting System;
23	8	6,209,146	Gonzalez	Ventilation Device for a Toilet;

1	9	6,219,853	Johnson	Toilet Ventilation System;
2	10	6,052,837	Norton et al.	Toilet Ventilation System;
3	11	6,233,750	Donald et al.	Toilet Bowl Ventilating Apparatus;
4	12	6,279,173	Denzin et al.	Devices and Methods for Toilet Ventilation Using Radar Sensor;
5	13	6,295,656	Tillen	Venting Apparatus for Flush Toilets;
6	14	6,298,500	Sollami	Ventilated Toilet Seat;
7	15	6,360,377	Sollami	Filtration Housing Unit for Use with a Ventilated Toilet Seat;
8	16	6,363,542	Pope, Sr.	Toilet Ventilator;
9	17	6,367,092	Carwell et al.	Charge Transfer Capacitance Sensing and Control System for an Integrated Venting System;
10	18	6,370,702	Iddings, Sr.	Toilet Enclosure with Ventilation System;
11	19	6,370,703	Kim et al.	Odorless Toilet;
12	20	6,457,186	Stewart	Air Cleaning Device for a Toilet Seat.

16

17 *Statement of Need*

18 At least twenty U.S. Patents attempting to address the problem of noxious odors
19 associated with the disposal of human bodily wastes into the porcelain bowl of a modern
20 flush toilet while sitting on the hinged seat to the same have issued within less than three
21 years prior to the present writing. The number and frequency of these is considered
22 testimony to the pervasiveness, severity, and persistence of the problem. A poignant need
23 for an effective means of removing the odor associated with disposal of human bodily wastes
24 into the porcelain bowl of a modern flush toilet while sitting upon the hinged seat of the
25 same is hence considered to exist.

SUMMARY OF THE INVENTION

Objects of the Invention

The encompassing object of the present invention is the removal of odors associated with the disposal of human bodily waste into the porcelain bowl of a modern flush toilet whilst sitting upon the hinged seat of the same.

A first auxiliary object of the present invention is the removal of odors associated with the disposal of human bodily waste into the porcelain bowl of a modern flush toilet whilst sitting upon the hinged seat of the same in a manner that introduces no safety hazards.

A second auxiliary object of the present invention is the removal of odors associated with the disposal of human bodily waste into the porcelain bowl of a modern flush toilet whilst sitting upon the hinged seat of the same in a manner that is unobtrusive to the user.

A third auxiliary object of the present invention is the removal of odors associated with the disposal of human bodily waste into the porcelain bowl of a modern flush toilet whilst sitting upon the hinged seat of the same in a manner that is applicable to a large range of sizes of toilet.

A fourth auxiliary object of the present invention is the removal of odors associated with the disposal of human bodily waste into the porcelain bowl of a modern flush toilet whilst sitting upon the hinged seat of the same in a manner that minimizes duct work required of installation.

A fifth auxiliary object of the present invention is the removal of odors associated with the disposal of human bodily waste into the porcelain bowls of a plurality of flush toilets in a building whilst sitting upon the hinged seat of any of the same.

Other ancillary objects of the present invention include automatic activation and applicability to both residential and commercial buildings.

1 *Principles of the Present Invention*

2 In achievement of the above stated objects of the present invention it is suggested that
3 a negative pressure differential with respect to ambient be applied proximate the back of the
4 top of the porcelain bowl of a standard flush toilet, that a remote blower be used to supply
5 this negative pressure differential, and that the remote blower be connected by conduit to a
6 manifold adapted to possess an appropriately located and disposed inlet.

7 It is suggested that the standard spacing between the mounting bolts connecting the
8 hinged seat, and typically a hinged lid also, be utilized for location of the manifold and its
9 inlet specifically utilizing two slots, one each presented by opposed lateral wings, each
10 possessing a width sufficient to admit one said mounting bolt. The manifold can then be
11 readily located for use upon any flush toilet having standard spacing between the bolts
12 utilized for connection of a hinged seat thereto. It is also suggested that the manifold inlet
13 possess a sufficiently diminutive height for allowing location between the top annular
14 substantially flat surface of the porcelain bowl and the bottom flat surface of the hinged seat
15 without replacement of the existing bolts or seat.

16 It is suggested that relatively small, in comparison with typical rectangular cross
17 section ventilation duct work, annular cross section, i.e. round, conduit be utilized between
18 the manifold and the remotely located blower. It is specifically suggested that standard
19 polyvinyl chloride (PVC) schedule 40 piping with an interior diameter of about one and one
20 half inches be utilized throughout both residential and commercial applications. This enables
21 the conduit to be disposed in plumbing passageways and to be hung within wall frames by
22 the sill. It is suggested that the remotely located blower be located in a housing facilitating
23 multiple conduit connections for a plurality of manifolds each located upon a separate flush
24 toilet within the same building. And it is suggested that an adapter be utilized for connection
25 of lengths of conduit of differing cross section to each other and the blower housing.

1 In optimization of the air flow dynamics of the inlet of the manifold proximate the top
2 surface of the porcelain bowl of a typical flush toilet, and in accommodation of the varying
3 depth dimensions from fore to aft of these porcelain bowls, it is suggested that a hood
4 possessing a pair of slots spaced apart the same distance as the two slots on the manifold, i.e.
5 the standard distance between the bolts connecting the hinged seat to the porcelain bowl, be
6 provided. The hood can extend over a rear portion of the top of the interior of the porcelain
7 bowl and the inlet of the manifold proper be disposed between the top substantially flat
8 surface of the porcelain bowl and the bottom flat surface of the hinged seat spaced apart
9 substantially in parallel thereabove.

10 It is suggested that the manifold and the hood both be constructed in plastic. This,
11 and the use of a remote blower and plastic conduit, are considered to minimize any potential
12 problems regarding corrosion or unwanted conduction of electricity occasioned by proximity
13 to water in the porcelain bowl of a human waste disposal flush toilet or any other water in
14 the room in which said toilet is located. Use of a blower remote from the porcelain bowl of
15 a flush toilet, and from any and all sources of water in the room in which the toilet is located,
16 minimizes the safety hazard otherwise poised by location of standard alternating current
17 supplied electrical motors in the same room.

18 It is suggested that electrical supply to the remote blower be activated by a wall
19 mounted light switch for the room in which each flush toilet with a manifold attached thereto
20 is located and that the separate vent for excessive humidity commonly required for
21 bathrooms having a shower or bath be connected via conduit to the remote blower exhausting
22 to the exterior of the building through conduit connected to an exhaust port of the blower
23 housing.

24 Flexible hose connecting the manifold to the rigid conduit is further suggested to
25 facilitate ease in installation. Use of either: (a) annular barbs upon a manifold extension and

1 a hose clamp for conventional connection; or (b) a rigid fastened flanged hose connection
2 to the manifold outlet facilitating quick and easy disconnection are suggested.

3 Other advantages and benefits of preferred embodiment of the principles relating to
4 the present invention may be appreciated in the detailed description following; particularly
5 if conducted with reference to the drawings attached hereto briefly described immediately
6 below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic view of a system in preferred accordance with the principles relating to the present invention providing a plurality of ordinary flush toilets in a single building with noxious odor removal.

FIGURE 2 is an isometric view of a manifold in preferred accordance with the principles relating to the present invention.

FIGURE 3 is an isometric view of a hood in preferred accordance with the principles relating to the present invention.

FIGURE 4 is an isometric view of a blower housing in preferred accordance with the principles relating to the present invention including depiction of a dual size conduit connector on an inlet port.

FIGURE 5 is a plain elevational detail view taken from a side of a flanged conduit connection.

FIGURE 6 is a plain elevational detail view taken from the bottom of a portion of the manifold extension illustrating a sensor port therethrough.

FIGURE 7 is a plain elevational view taken from a side of an adapter for lengths of conduit possessing differing sizes used as a hanger in a frame sill of a wall for hanging schedule 40 PVC conduit therein.

3

4 **FIGURE 9** is an isometric view of a blower housing similar to that depicted in **FIGURE**
5 **4** having a rectangular exhaust port.

NOMENCLATURE

1			
2			
3	10	flush toilet	37 hose connector
4	11	manifold	39 manifold extension
5	12	blower housing	50 annular projection
6	13	hood	51 gasket
7	15	manifold inlet	52 sensor port
8	16	wing	53 adapter
9	17	slot	55 vent
10	19	manifold outlet	56 light switch
11	20	blower	57 vertical vanes
12	21	exhaust port	59 aperture
13	22	inlet port	60 hanger
14	23	sleeve	61 female end
15	25	dual size conduit inlet port	62 shoulder
16	26	reduction plate	63 frame sill
17	27	flange	65 wiring
18	29	bolt hole	66 relay
19	30	conduit	67 circuit board
20	31	annular barbs	69 power supply
21	32	fore edge	70 regulator
22	33	rear edge	71 orifice
23	35	manifold plenum	72 door
24	36	medial section	73 handle

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

FIGURE 1 schematically depicts a ventilation system in preferred accordance with the principles relating to the present invention operative upon a plurality of flush toilets 10 each possessing a porcelain bowl with a substantially flat top surface and a seat hinged thereto possessing a flat bottom disposed, in operative position, substantially parallel to and spaced apart from the top surface of the porcelain bowl. The porcelain bowl, seat, and other components of the flush toilets 10 are well known and are hence undepicted in the drawings attached hereto. The size of the porcelain bowls vary, particularly in depth from front to rear including the cavity thereto and incidentally the associated seats, and a hood 13 adjustable during installation with respect to a manifold inlet 15 disposed at the back of the space between the top surface of the porcelain bowl and the bottom surface of the hinged seat accommodates this variation. Perhaps most importantly, it is noted that the hinged seat of a standard flush toilet 10 in the U.S.A. is attached to the porcelain bowl by a pair of mounting bolts that are spaced apart from each other a standard distance of five and one half inches center to center regardless of the size.

The conduit 30 seen in **FIGURE 1** also is simply represented as no depiction is considered necessary or desirable. The conduit 30 utilized in preferred embodiment of the principles relating to the present invention is well known and requires no modification: Schedule 40 PVC piping with an internal diameter (ID) of approximately one and a half inches (1.5"). Use of flexible hose that can be fitted, and preferably glued, to this PVC piping is recommended for connection of the manifold outlet 19 depicted in **FIGURE 2** to this conduit 30 and annular barbs 31 provided for this. Alternatively, or in addition, a standard hose clamp of appropriate diameter, i.e. about one and seven eighths inches (1.875") can be tightened about the flexible hose on either connection of the hose ends.

1 The most preferred connection of the manifold outlet 19 to the conduit 30 uses PVC
2 flexible hose that can be effectively glued to PVC conduit or PVC connectors and a hose
3 connector 37 facilitating a quicker and easier manual disconnection, preferably without the
4 use of tools, than achievable with use of a hose clamp with or without annular barbs 31 on
5 the manifold extension 39 or a conduit 30 connector.

6 A hose connector 37 is seen **FIGURE 5** to have an annular projection 50 possessing
7 an exterior adapted to engage the interior of the flexible hose and has flanges 27 butted
8 against the flanges 27 of the manifold extension 39. It is recommended that the hose
9 connector 37 be made of PVC, that a resilient gasket 51 possessing a matching ID be
10 disposed therebetween to ensure an air tight seal and that appropriate fasteners, not shown,
11 such as a pair of toggle clamps or wide pitch bolts and wing nuts, be used to fasten the two
12 opposed pairs of flanges 27 together with the fasteners passed through the bolt holes 29 in
13 the flanges 27. It is suggested that flexible PVC hose be used so it can be effectively glued
14 to the annular projection 50 and hose clamps are unnecessary to secure the connection. It
15 is emphasized that this connection of the manifold outlet 19 to the conduit 30 may be by any
16 means desired, that any functional equivalent fulfills the principles of the present invention.

17 It is also emphasized that schedule 40 PVC piping comprises the preferred conduit
18 30 but other sizes and other materials will suffice to fulfill the necessary function of the
19 conduit 30 in preferred embodiment of the principles relating to the present invention. It is
20 also suggested that round, preferably three inch (3") ID, metal duct be used in connection to
21 the inlet ports 22 and exhaust port 21 particularly on the blower housing 12 in commercial
22 buildings as in standard practice. The exhaust in any case is to the exterior of the building
23 through conduit 30. The use of larger diameter conduit 30 from the exhaust port 21 of a
24 blower housing 12, or the blower 20 directly, reduces back pressure considerably upon the
25 blower 20, and improves system performance.

1 It is commented that staged increases in the size of the air path are observed in a
2 system in preferred accordance with the principles relating to the present invention
3 facilitating effective supply of negative pressure differentials to a plurality of manifold inlets
4 15 using a single blower 20 located in a single blower housing 12. The manifold inlets 15
5 are of lesser area than schedule 40 PVC conduit 30, as demonstrated further below, and 3"
6 diameter metal duct has an interior area that is much larger still. It is further considered
7 desirable to accommodate use of both sizes of these types of conduit 30 in connection to the
8 blower housing 12. A dual size conduit inlet port 25 comprised of: a reduction plate 26 with
9 an aperture 59 for disposition of a male/female PVC connector; a gasket 51; and a 3"
10 diameter sleeve 23 with a annular flange 27 as depicted in **FIGURE 4** on one of the inlet
11 ports 22 of the blower housing 12 facilitates fixed connection of either schedule 40 PVC or
12 3" diameter metal conduit 30.

13 The annular flange 27 of the sleeve 23 is seen to possess a plurality of bolt holes 29
14 intended to match a set of bolt holes 29 of the same pattern through the wall of the blower
15 housing 12, the reduction plate 26, and the gasket 51 fitted between the reduction plate 26
16 and the exterior surface of the wall of the blower housing 12 with sheet metal bolts acting
17 upon the flange 27 of the sleeve 23 and compressing the assembly together in fastening the
18 same with engagement of the bolt holes 29 in the wall of the blower housing 12. All of the
19 bolt holes 29 here have the same pattern but the set through the wall of the blower housing
20 12 are intended to have a diameter approximating the root diameter of the bolts used while
21 the other bolt holes 29 are intended to have a diameter allowing free passage of the greater
22 full thread diameter of the bolts used. Ordinary sheet metal bolts or screws are suggested.

23 The blower housing 12 seen in **FIGURE 4** is preferably constructed in sheet metal.
24 A blower 20 is preferably bolted in position inside the blower housing 12 using the bolt holes
25 29 seen in **FIGURE 4** on either side of the exhaust port 21. An external sleeve 23 may also

1 be seen projecting outwardly from the exhaust port 21 and is intended to be fitted interiorly
2 to the conduit 30 used for exhaust in a conventional manner preferably using 3" metal
3 conduit 30. Installation of a length of PVC conduit 30 into an inlet port 22 using the aperture
4 59 provided by the reduction plate 26 can use an ordinary male to female PVC connector,
5 not shown, disposing the male end through the aperture 59 and pulling the shoulder of the
6 connector against the exterior surface of the reduction plate 26 with a lock ring, also not
7 shown) threaded onto the male end of the connector and tightened against the interior surface
8 of the reduction plate 26.

9 The blower housing 12 may have any desired number of inlet ports 22 and the inlet
10 ports 22 that are unused can simply be closed by plugs, not shown, that can be threaded to
11 be engaged by a lock ring and extend interiorly against a positive stop created by a flange 27.
12 Or, more simply, a flanged metal plug with compressible insert can be utilized or any other
13 type of fire proof plug preferably avoiding the use of duct tape although this also will
14 obviously suffice to seal the blower housing 12. It is expected that the blower 20 will need
15 to be sized to economically provide the negative pressure for all the manifolds 11 concerned.
16 A sensor port 52, as earlier mentioned, is considered very useful for this.

17 The adapter 53 depicted in **FIGURE 7** is specifically suited to adapt schedule 40 PVC
18 piping preferred for use as conduit 30 wherever possible in a system in preferred accordance
19 with the principles relating to the present invention. In most residential structures this is the
20 only type of conduit 30 preferred except for flexible hose connecting to the manifold
21 extension 39 and ordinary 3" diameter metal duct for exhaust. It is noted that a blower
22 housing 12 isn't strictly necessary although increasing the area of the airway, particularly
23 behind the blower 20, is desirable to minimize back pressure and in order to minimize
24 expense it is hence recommended that schedule PVC conduit 30 be used up to the blower 20
25 or blower housing 12 and 3" diameter metal duct for exhaust.

1 An adapter 53 such as that shown in **FIGURE 7** be used to connect the PVC conduit
2 30 on one side to metal conduit 30 on the other side if it is desired to run 3" diameter metal
3 conduit 30 through a building plenum to the blower housing 12. The metal conduit 30
4 recommended is ordinary galvanized mild steel ducting. Square or rectangular metal duct
5 can also be used. Extensive engineering has been conducted especially with regard to the
6 use of schedule 40 PVC piping as the conduit 30 conveying the negative pressure created by
7 a blower 20 in a blower housing 12 to a manifold 11 as specifically depicted in the drawing
8 figures attached hereto and, in brief, satisfactory air flow for several relatively long lengths
9 of conduit 30 including that for several vents 55 is readily obtained although this is perhaps
10 contrary to conventional expectations.

11 Schedule 40 PVC piping is very inexpensive and can be run through plumbing
12 passageways, including the space within the frame of a wall, while standard large rectangular
13 metal duct cannot. This is considered to provide a valuable attribute regardless of whether
14 the building concerned is commercial or residential as use of schedule 40 PVC enables the
15 conduit 30 to be hung from the frame sill 63 of a wall as depicted in **FIGURE 7**. The hanger
16 60 shown therein uses an adapter 53 with one female end 61, i.e. tapped, and a tapered
17 shoulder 62 of greater diameter than the aperture 59 cut through the frame sill 63 and sized
18 to permit passage of the female end 61. The upper end of a measured length of schedule 40
19 PVC conduit 30 is placed through the aperture 59 in the frame sill 63 and threaded into a
20 female end 61, preferably by threading and glueing, and is dropped into position.

21 It is noted that exhaust ventilation only required in the U.S.A. to disperse excessive
22 humidity or fog commonly created by a hot shower or bath. An internal blower without any
23 exhaust venting, often combined with an electrical resistive heating element, is hence a
24 commonplace in bathrooms. A 'bathroom' having a flush toilet 10 but no shower or bathtub
25 is not required to have any ventilation.

1 Lavatories in commercial buildings having many flush toilets 10 but no shower or
2 bathtub are not required by code to have ventilation. In these cases a system in accordance
3 with the principles relating to the present invention remedies an obvious problem. In cases
4 wherein a true vent 55 exists or is intended for a 'bathroom' or lavatory possessing at least
5 one flush toilet 10 it is suggested that the duct for the same be combined with the conduit 30
6 of the present invention. For the purposes of meeting building code requirements in the U.S.
7 it is noted that 50 cubic feet per minute of air flow is required and that the air flow through
8 the manifold inlet 15 and the vent 55 may be combined to meet this requirement and hence
9 a single conduit 30 and remote blower 20 for the 'bathroom' suffice.

10 The blower 20 represented in **FIGURE 1** is also a well known component, a
11 purchased item, and is hence also undepicted in the drawings attached hereto. The blower
12 20 requires an electrical power supply 69 and is remotely located with respect to the
13 manifold 11. It is recommended blower 20 operation be controlled with operation of a light
14 switch 56 in the rooms possessing flush toilets 10 and that a circuit board 67, at least one
15 relay 66 and appropriate wiring 65 be utilized. And if the conduit 30 conveying negative
16 pressure to the manifold inlet 15 proximate the back of the porcelain bowl of a flush toilet
17 10 is combined with the conduit 30 suppling exhaust for a separate vent 55 in the same room
18 it is further recommended that the remotely located blower 20 create the negative pressure
19 differential required of both.

20 A rotary vane alternating current (AC) 'squirrel cage' type blower is considered
21 appropriate for the blower housing 12 depicted in **FIGURE 4** but any type of blower 20 can
22 be utilized in preferred embodiment of the principles relating to the present invention. A
23 blower housing 12, in fact, is not strictly necessary to fulfillment of said principles as a
24 sufficiently diminutive blower can be located within the conduit 30. An integrated circuit
25 controlled rotating field direct current axial flow blower of the type commonly used for

1 cooling personal computers can easily be disposed in line with the conduit 30 for example
2 and more than one such blower 20 can be utilized in the same line if desired for purposes of
3 providing sufficient negative pressure at the manifold inlet 15.

4 If there is conduit 30 down stream from the exhaust port 21 or a very long length of
5 conduit 30 between the manifold outlet 19 and the exhaust port 21 or a large number of
6 bends, particularly 90°, in the conduit 30 it is suggested that more than one in-line blower
7 20 be utilized and specifically suggested that a pair of counter rotational blowers 20 be
8 closely, about the diameter of the vanes, spaced apart from each other to maximize the air
9 flow sustained and minimize back pressure hindering the same.

10 The use of a blower housing 12, however, and a conventional AC blower 20 obviates
11 these concerns and facilitates the supply of negative pressure relative to ambient pressure,
12 i.e. less than 14.69 psia or 0 psig; to the manifold inlets 15 of a plurality of manifolds 11
13 each connected by a separate line of conduit 30 to the blower housing 12 as represented
14 schematically in **FIGURE 1**. A number of flush toilets 10 are economically serviced in this
15 manner. It is, of course, sufficient with regard to the present invention to service only one
16 flush toilet 10 regardless of the use of a blower housing 12.

17 The manifold inlet 15, as mentioned before, must be sufficiently shallow to fit
18 between the top substantially flat surface of the porcelain bowl of an ordinary flush toilet 10
19 and the bottom flat surface of the seat hinged thereto. The distance between these two
20 surfaces is typically a little more than, but can be as little as, one half of an inch (0.500") and
21 it is hence suggested that the total height of the manifold inlet 15 be restricted to this
22 measure. The suggested diameter of the conduit 30 connected to the manifold 11, inclusive
23 of rigid pipe or duct or flexible hose, is larger than this and hence it is suggested that the
24 manifold outlet 19 possess an effective diameter substantially greater in dimension than the
25 height of the manifold inlet 15.

1 The manifold 11 specifically depicted in **FIGURE 2**, taken directly from engineering
2 prints for prototypical manufacture, has a manifold inlet 15 three and three eighths inches
3 (3.375") wide and three eights of an inch (0.375") high. This respectively includes four and
4 two walls all approximately one sixteenth of an inch (0.0625") thick. The resulting air
5 passage is hence $[3.375" - (4)(0.0625")] \times [0.375 - (2)(0.0625")] = [3.125"] \times [0.250"] =$
6 0.78125 in^2 . The manifold outlet 19 has an ID of 1.319" and a passage of $\pi(r)^2 = \pi(ID/2)^2$
7 $= \pi(0.6595")^2 = 3.1415962(0.6595)^2 = 1.3664 \text{ in}^2$. The manifold outlet 19 hence possesses
8 a passage that is $1.3664 \text{ in}^2 / 0.78125 \text{ in}^2 = 1.75$ times greater than that possessed by the
9 manifold inlet 15.

10 Physics dictates that the air flow through each be the same, as the manifold 11 has no
11 other openings, and hence the velocity of the air flow through the manifold inlet 15 is 1.75
12 times greater than that through the manifold outlet 19. A manifold plenum 35 with a rounded
13 top is located behind the manifold inlet 15, connecting it to a laterally located manifold
14 extension 39 having the annular cross section manifold outlet 19 at its termination. This
15 rounded top facilitates laminar flow from the necessarily shallow and wide manifold inlet
16 15 to the preferably annular manifold outlet 19. Laminar flow is preferred over turbulent
17 flow in being more efficient, quieter, and more effective in removal of odors.

18 A sensor port 52 is preferably provided, as seen in **FIGURE 6**, through the underside
19 or bottom surface of the manifold extension 39 for insertion of an airflow probe to provide
20 the velocity of the air flow and hence, with the cross sectional area of the manifold extension
21 39 known, the volume rate of air flow is readily yielded. This is considered a significant and
22 valuable feature as it provides empirical, objective, verification that a system in accordance
23 with the principles relating to the present invention has been properly installed and is
24 functioning properly. Assistance during installation in sizing the blower 20 is considered to
25 be the most significant direct benefit of this.

1 The hood 13 depicted in **FIGURE 3** is considered vital to both proper installation and
2 operation of a toilet ventilation system in accordance with the principles relating to the
3 present invention. As mentioned earlier, the porcelain bowls of typical, modern, flush toilets
4 **10** in the U.S. vary dimensionally. Every dimension varies except the standard spacing
5 between the mounting bolts for the hinged seat and, typically, lid. The width and, most
6 importantly, the length: from fore to aft; of the porcelain bowl varies. The width of the
7 manifold inlet 15 is restricted by the distance between the two mounting bolts. The height
8 of the same is restricted by the space between the top surface of the porcelain bowl and the
9 bottom surface of the seat hinged thereto.

10 The position of the manifold inlet 15 with respect to the porcelain bowl is determined
11 by the difference between the actual and the minimum distance between the cavity of the
12 porcelain bowl and the back of the exterior of the same because the manifold plenum 35
13 necessarily extends below the top surface of the porcelain bowl behind the same and the
14 front of the manifold 11: the manifold inlet 15 cannot extend beyond the rear edge of the
15 porcelain bowl cavity on the smallest model. The effectiveness of the negative pressure
16 differential or suction supplied by the remote blower 20 through the conduit 30 to the
17 manifold inlet 15 in removing noxious odors resulting from defecation, primarily, into the
18 flush toilet **10** depends upon proximity of the manifold inlet 15 with the source of the odor.

19 For this reason a hood 13 is supplied with a curved fore edge 32 to the medial section
20 **36** preferably possessing a curvature approximating that of the cavity of the porcelain bowl
21 of the flush toilet **10**. The rear edge 33 of the medial section **36** of the hood 13 is straight as
22 it overlaps the top surface of the manifold 11 between the two wings 16 each with a slot 17
23 for attachment to the mounting bolts for the hinged seat of the flush toilet **10**. The wings 16
24 of the hood 13 are long enough to ensure this overlap even on the largest length of porcelain
25 bowl. On smaller bowls the wings 16 are trimmed off.

1 The open slots 17 of the wings 16 of the hood 13 are intended, as are the closed slots
2 17 in the wings 16 of the manifold 11, to be engaged by the pair of uniformly spaced apart
3 hinged seat mounting bolts on a standard flush toilet in the U.S. which, in installation, are
4 loosened and then tightened after locating the exterior of the manifold plenum 35 against the
5 rear of the porcelain bowl and the hood 13 such that the rear edge 33 of the medial section
6 36 overlaps the top of the manifold 11, including the manifold inlet 15, with the fore edge
7 32 of the hood 13 preferably overhanging the rear edge of the porcelain bowl cavity by the
8 same distance as the height of the manifold inlet 15, or about 3/8" in the case depicted in the
9 drawings attached hereto.

10 The portion of the wings 16 of the hood 13 extending rearward or aft of the mounting
11 bolts is superfluous and is preferably trimmed away: i.e. removed by cutting, or, since the
12 hood 13 is preferably made of plastic, snapped off with a flat rigid and hard object with a
13 straight edge, such as a length of steel bar, first placed with an edge above the extent desired
14 and the excess length of the two wings 16 pulled upward until separation is achieved.
15 Assuming the hood 13 is made of thermoplastic, the preferred material, trimming the wings
16 16 can also be done with heat applied in a linear band across the desired trim line.

17 The heat can be supplied most easily by an electrical resistive element or a torch. It
18 is not necessary to melt entirely through the intended part line. Once the substantially linear
19 margin about the intended part line obtains a plastic state the excess portion of the wings 16
20 maybe moved upward, in a manner similar to that described directly above for snapping off
21 the excess portion of the wings 16, and elongation of the linear margin in a plastic state will
22 readily enable the excess portions to be removed by simply pulling the same away.

23 A smooth edge is obtained in this manner, in contrast to either cutting with a saw or
24 snapping the excess wing 16 portions off as described directly above, and heat may also be
25 applied after removal of the excess wing 16 portions by cutting or snapping to obtain a

1 smooth edge. Alternatively, the sharp or rough edges obtained by cutting or snapping may
2 be abraded smooth using a sanding block, sand paper, file, emery board, et cetera.

3 Injection molding of both the hood 13 and the manifold 11 in thermoplastic is the
4 most preferred manner of manufacture of these components. While blow, i.e. vacuum,
5 molding of the hood 13 is also attractive the precision obtainable with injection molding is
6 not readily achievable by blow molding. Construction of either component can also be
7 achieved by welding together sub-components. The medial section 36 of the hood 13
8 depicted in **FIGURE 3** is readily manufactured from molded thermoplastic sheet and welded
9 to wings 16 either molded or cut from flat sheet. But integral construction is preferred.

10 Similarly, the manifold 11 depicted in **FIGURE 2** is readily welded or glued together
11 from sub-components. The flat top including the two wings 16 each possessing one slot 17
12 can be molded or cut from flat sheet and attached to a injection or blow molded body for the
13 manifold plenum 35 with the manifold extension 39 comprising a third sub-component
14 attached to the body. The two vertical vanes 57 seen in **FIGURE 2** to divide the manifold
15 inlet 15 into three air passageways can also comprise sub-components molded, cut, or cast
16 from or into flat sheet and then attached to the manifold 11 in assembly. These vanes 57 are
17 not necessary to fulfillment of the principles relating to the present invention but are useful
18 in ensuring laminar air flow through the manifold inlet 15.

19 It is considered that while the blower 20 is a purchased component the size of the
20 same must be in accordance with the system as installed and this depends upon the number
21 of manifolds 11, the length of the conduit 30, the number of right angles in the conduit 30,
22 and the size of the conduit 30, i.e. the total load, that this is expected to vary considerably
23 and, further, that the size requirement of the blower 20 is not readily calculated. The sensor
24 port 52 is provided primarily for assistance in installation. It can be used to size the blower
25 20 but, preferably, is used in conjunction with a regulator 70 preferably provided on the back

1 of the blower housing 12 as seen in **FIGURE 8**.

2 The purpose of the regulator 70 is primarily to allow use of a single size blower for
3 most residential installations in which a maximum of three manifolds 11 are contemplated,
4 a maximum load is known, and a standard, maximum load sized, blower 20 can be provided.
5 In the case of maximum load the regulator 70 will be closed and otherwise it can be opened
6 to compensate for lesser loads. Readings of volume air flow through a manifold 11 using a
7 sensor port 53 provide empirical data for regulation of the compensation provided by the
8 regulator 70. Opening the same reduces the pressure differential, and hence the measured
9 air flow through, all the manifolds 11 in a system in accordance with the principles relating
10 to the present invention.

11 The particular regulator 70 depicted in **FIGURE 8** is comprised simply of a sliding
12 door 72 held in place by two spaced apart horizontal flanges 27 displaceable manually by
13 means of a handle 73 in typically, as shown, partial closure of the orifice 71 preferably
14 disposed, as depicted, on the back end of the blower housing 12, opposite the exhaust outlet
15 21. It is emphasized that any other configuration will suffice, that a round plate used as a
16 door 72, for example, rotated to close and open the orifice 71 might be even simpler to
17 implement and that multiple orifices 71 can be used as well.

18 **FIGURE 9** depicts use of a rectangular exhaust port 21 and disposition of a single
19 relay 66 on the side of the blower housing 12 opposed to the inlet ports 22. None of this is
20 necessary. It is simply suggested for the sake of convenience. A rectangular exhaust port
21 more readily conforms to the exhaust configuration of a typical blower and while it is
22 preferred in installation to exhaust through 3" round metal duct an adapter 53 with one
23 rectangular end and one round end will readily attach to the sleeve 23 of the rectangular
24 exhaust port 21 depicted in **FIGURE 9** and facilitate attachment of 3" round metal conduit
25 30 in a manner similar to that depicted in **FIGURE 7**. The adapter 53 depicted therein is

1 intended to adapt 1.5" PVC conduit **30** to 3" round metal conduit **30** and it is suggested that
2 it be made of PVC or another plastic. It is noted that the larger conduit **30** is seen to be fitted
3 exteriorly to the adapter **53** while the smaller conduit **30** is inserted into the opposed end of
4 the same and, as previously mentioned, is preferably threaded therein. An adapter **53** for a
5 rectangular exhaust port **21** is preferably made of sheet metal and it is largely irrelevant as
6 to whether the ends of the adapter **53** fit interiorly or exteriorly to the sleeve **23** about the
7 exhaust port **21** or the end of the conduit **30** so connected.

8 It is emphasized that the foregoing is intended to provide one practiced in the art with
9 the best known manner of making and using a system in preferred accordance with the
10 principles relating to the present invention and the same is not to be construed in any manner
11 as being restrictive of said principles nor of the rights and privileges obtained by Letters
12 Patent for which